PB-240 152

COLORADO RIVER BACTERIOLOGICAL SURVEY PARKER STRIP AND LAKE HAVASU, MAY 25-29, 1973

Environmental Protection Agency

Prepared for:

Arizona State Department of Health

September 1973

DISTRIBUTED BY:

NTIS

National Technical Information Service
U. S. DEPARTMENT OF COMMERCE

BIBLIOGRAPHIC DATA SHEET	1. Report No.	2.	PB 240 152

4. Title and Subtitle

Colorado River Bacteriological Survey
Parker Strip and Lake Havasu, May 25-29, 1973

5. Report Date: September, 1973

6.

7. Author(s): Arizona, Department of Health
U S. Environmental Protection Agency, Region IX

8. Performing Organization Rept. No. 909/9-73-002

9. Performing Organization Name and Address

U.S. Environmental Protection Agency
Region IX, Surveillance and Analysis Div.
100 California Street, San Francisco, CA 94111

10. Project/Task/Work Unit No.

11. Contract/Grant No.

12. Sponsoring Organization Name and Address

U.S. Environmental Protection Agency
Region IX
100 California Street
San Francisco, CA. 94111

AND

State of Arizona
Dept. of Health

13. Type of Report & Period Covered

14.

15. Supplementary Notes

16. Abstracts

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17. Key Words and Document Analysis. 17a. Descriptors

~~XXXXXXXXX~~ coliforms, sewage disposal, recreation

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NATIONAL TECHNICAL
INFORMATION SERVICE
US Department of Commerce
Springfield, VA. 22151

17b. Identifiers/Open-Ended Terms

Colorado River, Lake Havasu, Parker Strip

17c. COSATI Field/Group

PRICES SUBJECT TO CHANGE

18. Availability Statement	19. Security Class (This Report)	21. No. of Pages
no restriction on distribution. available from National Technical Information Service, Springfield, VA 22161	UNCLASSIFIED	41
	20. Security Class (This Page) UNCLASSIFIED	22. Price 3.75-2.25

EPA-909/9-73-002

COLORADO RIVER BACTERIOLOGICAL SURVEY
PARKER STRIP AND LAKE HAVASU

May 25-29, 1973

A Joint Study by the

U.S. Environmental Protection Agency, Region IX
and
State of Arizona, Department of Health

Report Prepared by

Surveillance and Analysis Division
U.S. Environmental Protection Agency, Region IX
San Francisco, California

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SUMMARY

A bacteriological survey of the Parker Strip - Lake Havasu areas of the Colorado River was conducted jointly by the State of Arizona and the Environmental Protection Agency, Region IX, during the Memorial Day weekend, May 25-29, 1973. Results of the study showed that fecal coliform counts exceeded the levels recommended for primary contact recreation water at Blue Water Marina and Buckskin Mountain State Park. Disease-causing bacteria (Arizona group, Salmonellae) were recovered from the River in the vicinity of the pipe carrying effluent from the Buckskin treatment plant. Included is a photograph of people swimming and playing next to this effluent pipe. Photographic evidence documents ponding of liquid over the septic tank leach fields during a peak-use period at Crazy Horse State Park. The public has easy access to this area.

ACKNOWLEDGEMENTS

This study was conducted jointly by the U.S. Environmental Protection Agency, Region IX, Surveillance and Analysis Division, and the State of Arizona, Department of Health.

The final report was prepared by Kathleen G. Shimmin, Lab Support Branch, Surveillance and Analysis Division, EPA Region IX, in cooperation with William H. Shafer, Jr., State of Arizona, Department of Health, who authored the Introduction.

R. Mandel, Surveillance and Analysis Division, EPA Region IX, obtained shore samples and prepared field notes at shoreline sampling stations. Lab analyses were performed by Helen Johnson, Lab Support Branch, Surveillance and Analysis Division. W. Shafer and R. Munari, Department of Health, State of Arizona, obtained deep water samples and prepared field notes at deepwater sampling stations. Photographs were taken by K. Shimmin and R. Mandel.

FINDINGS

1. Blue Water Marina does not provide adequate sewage disposal facilities and the River is contaminated during peak-use periods.

   Control measures might include placing chemical toilets at convenient intervals along the beach, extending the existing sanitary system, and limiting the number of people the concessionaire admits to the beach.

2. The Colorado River at Station 1A (above the Blue Water Marina Beach) is contaminated. The source is undetermined.

3. Buckskin Mountain State Park does not provide adequate sewage disposal facilities and the River is contaminated during peak-use periods. Control measures could include limiting the number of campers, increasing the amount of chlorination during peak use periods, and enlarging the treatment plant or otherwise ensuring adequate operation.

4. The effluent pipe from the Buckskin Mountain package treatment plant is poorly located. The end is exposed during low-water periods and is in close proximity to a swimming area. The area is presently not posted to limit swimming in the immediate vicinity of the pipe.

5. At Crazy Horse Campground concession the septic tank leach field area is inadequate and sewage ponds on the surface. Public access to the area is not limited, nor is the area posted as to the public health hazard.

INTRODUCTION

The Parker Strip is 14.6 miles of Colorado River located between Parker Dam and Headgate Rock Diversion Dam. On the Arizona side of the river, property rights are a patchwork of private, Indian, state, county, and federal ownership. Some of the property has been extensively developed and exploited, while some has remained almost untouched. Intense development and extensive water recreation, coupled with marginal waste disposal facilities, have created concern among local, county, state and federal health agencies. This report contains the results of one cooperative study between the Environmental Protection Agency and the Arizona State Department of Health.

Initial development of the Parker Strip took place on private, Indian, and public lands that were available and suitable for vacation cabin and/or trailer sites. Suitable sites in general were level areas adjacent to the river on shallow alluvial sands and gravels. These alluvial deposits occur at mouths of numerous intermittent watercourses. Remaining lands, particularly at the upstream reach near Parker Dam, are composed of sandstone, limestone, shale and some granite gneiss. This topography limits areas suitable for septic tanks and disposal fields. Some alluvial areas have good soil permeability but their utility is limited by high groundwater tables in areas adjacent to the river.

Increased development and density of building trailer parks and recreation sites have placed a high demand on existing waste treatment systems, particularly those systems for which there is little or no room for expansion. Many of the original septic tank leach field systems are substandard in design; some have been referred to as imaginative. To reduce the load on inadequate systems, pipes have been run directly to the river to carry kitchen and other sink wastes, to relieve overload leaching areas and in some cases to carry raw sewage.

Every three years, during January or February, the river level is lowered significantly. During these periods of flow, state and county officials have walked the shoreline and investigated all pipes for purpose and origin. Particular attention has been paid locating raw sewage sources or failing leaching systems. In cooperation with Yuma County, all systems carrying untreated wastewater to the river have been eliminated. However, the inspection frequency is such that more recent discharges are possible.

Buckskin Mountain State Park is served by a 10,000-gallon per day extended aeration wastewater treatment plant. Effluent from the plant is chlorinated and discharged to the river upstream of a swimming area. A sharp bend in the river above the swimming area may carry the effluent to the opposite side of the river. Complaints regarding plant operation have been received in the past. Current operation, verified by periodic inspections by the Arizona State Department of Health, has been fairly good but the potential for operation difficulties is always present. Experience has shown that operation problems are common with this type of treatment.

Recreational use of the Strip area is at a maximum on weekends, but major holidays tax all facilities to the limit. The strain on facilities coupled with body contact water recreation create a potential health hazard. Overcrowding of beaches and camping areas places additional demands on sanitary facilities.

Complaints are frequent and relate to overflowing septic tanks, broken waste lines in trailer parks and fecal contamination of the river. Complaints regarding septic tanks and waste lines can be verified, and corrective action is usually forthcoming in a reasonable length of time. Complaints regarding the river have been more troublesome.

Because of the preceding conditions, both the Environmental Protection Agency and the Arizona State Department of Health decided independently to do bacteriological sampling over the Memorial Day weekend. This sampling effort was combined into a single study to meet both federal and state needs. Sampling locations were selected to monitor point sources and their impact on the river, above and below areas with potential septic tank problems and at important recreation areas.

METHODS

The mobile laboratory was stationed near the Federal housing area at Parker Dam. Samples were collected and delivered to the laboratory in shifts so that all processing could be completed within four to five hours of collection.

Station locations are listed in Table 1. Some beach areas were sampled from the land (1A,B,C,D; 6A,B,C; 8A,B; 9A,B) and the remainder collected by boat (2A,B; 3; 4A,B; 5). Personnel from Arizona Department of Health, collected the boat samples; EPA collected land samples. Maps of the locations are shown in Figures 1 and 2.

The study extended for five days, May 25 - 29, 1973. Total and fecal coliform tests were performed daily. Based upon the findings of the first two days, four locations were selected for Salmonella studies: Stations 1D (Blue Water Marina, downstream of beach); 5 (Ah-Villa Park); 6B (Buckskin Mountain State Park, receiving water at end of discharge pipe); and 8B (Lake Havasu, Crazy Horse Campground, center of beach area). Salmonella testing was done for two days - May 27 & 28, 1973.

Membrane filter methods were employed for total and fecal coliforms. Techniques were in accordance with Standard Methods, 13th Ed. and the more restrictive Region IX methodology.

Samples collected for Salmonella enrichment were returned to the mobile laboratory, where they were filtered through diatomaceous earth and placed overnight in enrichment broth at 35°C. Details of the procedure are spelled out in the Region IX Salmonella methodology. The enrichments were then packed securely, put on ice and air-transported to the Alameda Laboratory.

In Alameda the enrichments were transferred to fresh enrichment broth and put into incubators at three temperatures: 37°, 41.5°, 43°C. Plating and incubation proceeded from this point as in the routine Salmonella procedure. Salmonella isolates were confirmed by the typing center at the State of California Department of Health, Berkeley, CA.

TABLE 1
STATION NUMBERS AND DESCRIPTIONS
(Unless otherwise indicated all Stations
are on Arizona side of Colorado River)

1A	Blue Water Marina, 15 feet north of biggest clump of bushes at turnout.
1B	Blue Water Marina opposite "No Parking within 15 Feet of Pavement", upstream of restaurant.
1C	Blue Water Marina opposite east/west fence on beach nearest restaurent.
1D	Blue Water Marina, lower end of bathing beach, by HUD, STP sign.
2A	Sports Valley upstream of restaurant, 10 feet above dock.
2B	Sports Valley downstream, 50 feet below dock, 20 feet from shore.
3	Moovalya Keys, 100 yds into lagoon effluent at first canal junction.
4A	Bransons (below), Arizona side, Rancho Del Rio Dock, 50 feet offshore.
4B	Opposite Bransons, California side, below Windmill Trailer Park.
5	Ah-Villa Park, Arizona side, at downstream park fence.
6A	Buckskin Mt. State Park, 200 feet upstream from discharge pipe, opposite large tree on point of land.
6B	Buckskin Mt. State Park, receiving water, at end of discharge pipe.
6C	Buckskin Mt. State Park, 100feet downstream from discharge pipe, opposite eucalyptus tree.
7A	Polynesian Shores, upstream, at USGS gage, 590 ft. cable mark.
7B	Polynesian Shores below, 100 feet above power lines
8A	Crazy Horse Campground, north inlet off beach (Lake Havasu).
8B	Crazy Horse Campground, center beach by lifeguard warning sign (Lake Havasu).
9A	Lake Havasu, Day use State Park, right of gazebo on left side of diving raft.
9B	Lake Havasu, Day use State Park, left edge of swimming area near gazebo.

Source: Microbiology, EPA-Region IX, 8/73

FIGURE 1. STATION LOCATIONS, COLORADO RIVER PARKER STRIP AREA - MAY, 1973

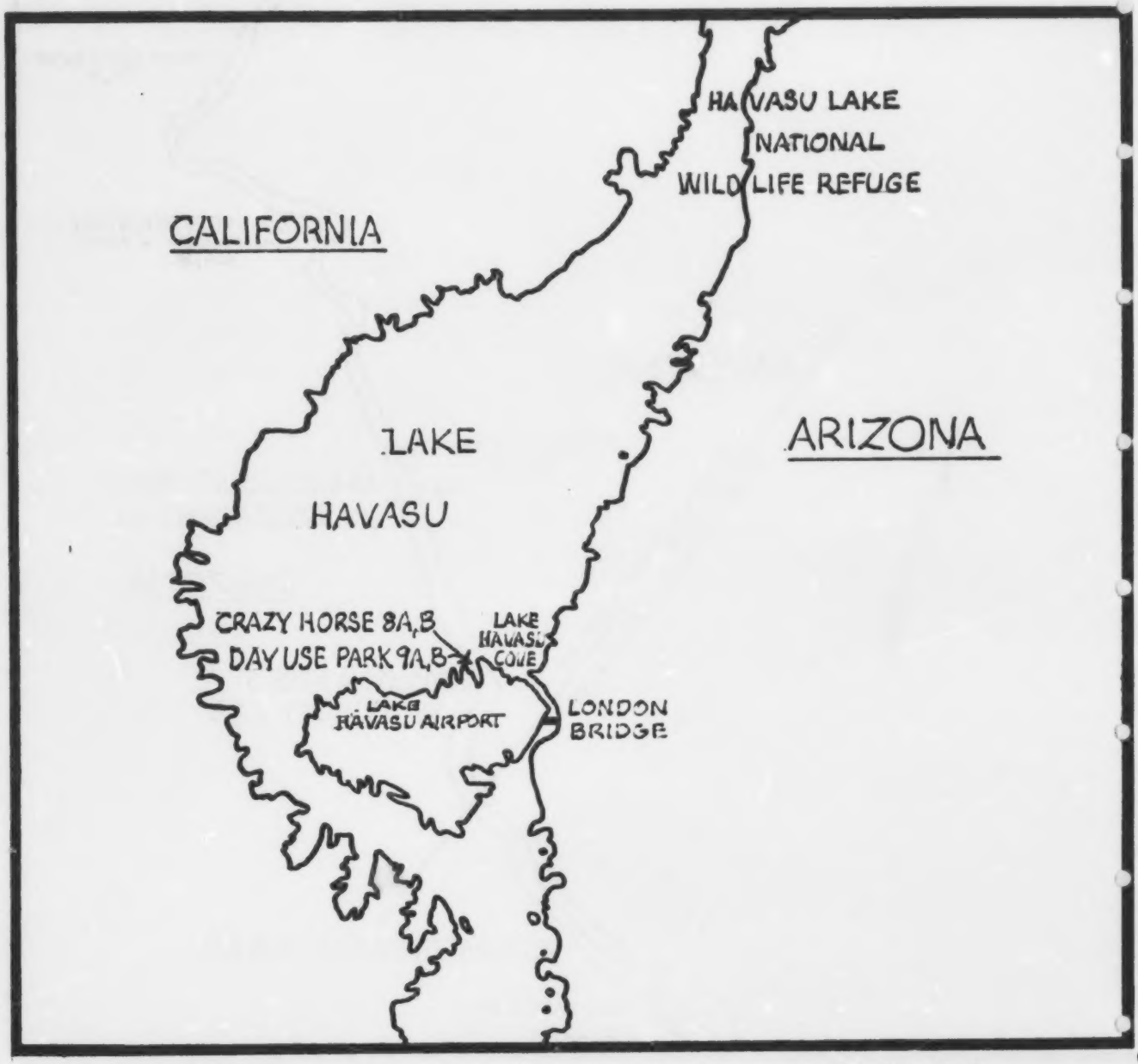

FIGURE 2. STATION LOCATIONS. COLORADO RIVER LAKE HAVASU AREA - MAY, 1973

COLORADO RIVER SURVEY

PARKER DAM - LAKE HAVASU AREA

5/25/73 - 5/29/73

STATION DESCRIPTION

1A Blue Water Marina 15 feet north of biggest clump of bushes at turnout.

1B Blue Water Marina opposite "No parking within 15 feet of pavement" upstream of restaurant.

1C Blue Water Marina opposite east/west fence on beach nearest restaurant.

1D Blue Water Marina beach - by HUD STP sign, lower end downstream.

STATION	DATE	TOTAL COLIFORMS/100ml	FECAL COLIFORMS/100ml
1A	5/25/73	6,600	100
1B	"	4,000	<130
1C	"	3,400	<130
1A	5/26/73	11,000	260
1B	"	>8,000	<130
1C	"	8,300	<130
1A	5/27/73	22,000	400*
1B	"	13,000	260
1C	"	15,000	130*
1D	"	18,000	1000
1A	5/28/73	42,000	540
1B	"	27,000	190
1C	"	22,000	<130
1D	"	6,700	<130
1A	5/29/73	27,000	210
1B	"	>2,600	<130
1C	"	8,600	<130
1D	"	2,800	<130

* Estimated value, observations not within statistically significant range.

Table 2. Total and Fecal Coliform per 100 ml by Station.

Source: Microbiology, EPA-Region IX, 8/73

COLORADO RIVER SURVEY

PARKER DAM - LAKE HAVASU AREA
5/25/73 - 5/29/73

STATION DESCRIPTION

2A Sports Valley above restaurant, 10 feet above dock.

2B Sports Valley 50 feet below restaurant dock, 20 feet out.

3 Moovalya Keys about 100 yards into lagoon effluent at first canal junction.

STATION	DATE	TOTAL COLIFORMS/100ml	FECAL COLIFORMS/100ml
2A	5/25/73	13,000	<130
2B	"	7,600	<130
2A	5/26/73	>8,000	<130
2B	"	7,000	<130
2A	5/27/73	13,000	<130
2B	"	4,600	<130
2A	5/28/73	>8,000	<130
2B	"	2,300	
2A	5/29/73	2,600	<130
2B	"	1,000	<130
3	5/25/73	8,000	<130
3	5/26/73	5,300	<130
3	5/27/73	5,800	<130
3	5/28/73	4,000	<130
3	5/29/73	1,600	<130

Table 2 (Continued - 1)

Source: Microbiology, EPA-Region IX, 8/73

COLORADO RIVER SURVEY

PARKER DAM - LAKE HAVASU AREA

5/25/73 - 5/29/73

STATION DESCRIPTION

4A Bransons on Arizona side below Bransons at Rancho Del Rio Dock 50 feet offshore.

4B Bransons on California side below Windmill Trailer Park.

5 Ah-Villa Park on Arizona side at lower park fence.

STATION	DATE	TOTAL COLIFORMS/100ml	FECAL COLIFORMS/100ml
4A	5/25/73	6,600	<130
4B	5/25/73	6,600	<130
4A	5/26/73	> 8,000	<130
4B	5/26/73	5,300	<130
4A	5/27/73	7,600	<130
4B	5/27/73	2,700	<130
4A	5/28/73	5,800	<130
4B	5/28/73	6,000	<130
4A	5/29/73	9,300	<130
4B	5/29/73	7,000	<130
5	5/25/73	8,800	<130
5	5/26/73	12,600	<130
5	5/27/73	11,000	<130
5	5/28/73	7,300	<220
5	5/29/73	1,200	<130

Table 2 (Continued - 2)

Source: Microbiology, EPA-Region IX, 8/73

COLORADO RIVER SURVEY

PARKER DAM - LAKE HAVASU AREA

5/25/73 - 5/29/73

STATION DESCRIPTION

6A Buckskin Mt. State Park 200 feet upstream from discharge pipe opposite large tree on point.

6B Buckskin Mt. State Park at end of discharge pipe

6C Buckskin Mt. opposite eucalyptus downstream from pipe (about 100 ft.)

STATION	DATE	TOTAL COLIFORMS/100ml	FECAL COLIFORMS/100ml
6A	5/25/73	2,000	< 130
6B	5/25/73	6,000	230
6C	5/25/73	8,400	< 130
6A	5/26/73	19,000	< 130
6B	5/26/73	9,300	< 130
6C	5/26/73	3,700	< 130
6A	5/27/73	14,000	< 130
6B	5/27/73	55,000	1,500
6C	5/27/73	16,000	< 130
6A	5/28/73	8,700	< 130
6B	5/28/73	29,000	660
6C	5/28/73	> 6,700	180
6A	5/29/73	16,000	210
6B	5/29/73	21,000	190
6C	5/29/73	> 15,000	560

Table 2 (Continued - 3)
Source: Microbiology, EPA-Region IX, 8/73

COLORADO RIVER SURVEY

PARKER DAM - LAKE HAVASU AREA

5/25/73 - 5/29/73

STATION DESCRIPTION

7A Polynesian Shores above at USGS gage at 590 ft. mark cable.

7B Polynesian Shores, below, 100 feet above power lines.

STATION	DATE	TOTAL COLIFORMS/100ml	FECAL COLIFORMS/100ml
7A	5/25/73	4,400	<130
7B	5/25/73	* 4,000	<130
7A	5/26/73	6,600	<130
7B	5/26/73	6,200	<130
7A	5/27/73	5,400	<130
7B	5/27/73	>16,000 (confluent)	<130
7A	5/28/73	4,000	<130
7B	5/28/73	4,400	<130
7A	5/29/73	4,200	<130
7B	5/29/73	2,200	<130

* Estimated value, observations not within statistically significant range.

Table 2 (Continued - 4)

Source: Microbiology, EPA-Region IX, 8/73

COLORADO RIVER SURVEY

PARKER DAM - LAKE HAVASU AREA

5/25/73 - 5/29/73

STATION DESCRIPTION

8A Crazy Horse- North inlet off beach.

8B Crazy Horse - Center beach by lifeguard warning sign.

STATION	DATE	TOTAL COLIFORMS/100ml	FECAL COLIFORMS/100ml
8A	5/25/73	760	<130
8B	5/25/73	440	<130
8A	5/26/73	3,000	140
8B	5/26/73	2,500	<130
8A	5/27/73	2,200	270
8B	5/27/73	2,700	230
8A	5/28/73	1,600	<130
8B	5/28/73	460	<130
8A	5/29/73	>530	<130
8B	5/29/73	460	<130

Table 2 (Continued - 5)

Source: Microbiology,EPA-Region IX, 8/73

COLORADO RIVER SURVEY

PARKER DAM - LAKE HAVASU AREA

5/25/73 - 5/25/73

STATION DESCRIPTION

9A Lake Havasu - Day use State Park Right of gazebo on left side of diving raft.

9B Lake Havasu - Day use State Park Left edge of swimming area near gazebo.

STATION	DATE	TOTAL COLIFORMS/100ml	FECAL COLIFORMS/100ml
9A	5/25/73	1,700	<130
9B	5/25/73	*1,200	<130
9A	5/26/73	2,900	<670
9B	5/26/73	2,400	<130
9A	5/27/73	3,300	<130
9B	5/27/73	5,900	<130
9A	5/28/73	2,400	<130
9B	5/28/73	2,600	<130
9A	5/29/73	700	<130
9B	5/29/73	1,700	<130

* Estimated value, observations not within statistically significant range.

Table 2 (Continued - 6)

Source: Microbiology,EPA-Region IX, 8/73

RESULTS

Total and fecal coliform data are presented in Table 2, pages 8 - 14. Arizona water quality standards state that for primary contact recreation the following applies. "The fecal coliform content of primary contact recreation waters shall not exceed a geometric mean of 200/100 ml, nor shall more than 10% of the total samples during any 30-day period exceed 400/100 ml, as determined by multiple-tube fermentation or membrane filter procedures, and based on a minimum of not less than five samples taken over not more than a 30-day period."

Table 3 shows those stations which exceeded the water quality standards either by having a geometric mean greater than 200/100 ml or by having more than 400/100 ml more frequently than 10% of the time. It may be noted that two stations in the Blue Water Marina area (1A, 1D) and two stations along the Buckskin Mountain State Park beaches (6B, 6C) violate these fecal coliform limits. Salmonellae (Arizona Group) were isolated from Station 6B, near the discharge of sewage effluent from the Buckskin Mountain treatment plant.

Table 4 shows use figures for various parks during the period of the study. The Parker weekly newspaper, the Parker Pioneer (May 31, 1973) estimated that about 30,000 to 40,000 people visited the area during the Memorial Day weekend.

Figure 3 is a photograph of Blue Water Marina Beach. Figures 4 and 5 show the effluent pipe at Buckskin Mountain State Park. Figures 6 and 7 show crowded conditions at Crazy Horse Beach. Figures 8 shows a lavatory and percolation bed at Crazy Horse. Figures 9 through 11 show ponding over this same percolation bed.

Station Number	FECAL COLIFORM VALUES		
	Geometric Mean per 100 ml	Greater than 400/100 ml	
		Number Samples/5 total	Percent
1A	260	1	20
1D	<130	1	20
6B*	130	2	40
6C	<100	1	20

*Salmonellae (Arizona Group) isolated

Table 3, Stations showing Violations of Fecal Coliform Limits for Primary Contact Recreation Waters.

Source: Microbiology,EPA-Region IX, 8/73

	VISITATION FIGURES* BY DATE						
LOCATION (#)	5/23	5/24	5/25	5/26	5/27	5/28	5/29
Ah-Villa (5)	500	1,000	1,500	2,000	4,000	4,000	2,000
Buckskin Mtn. (6)	186	372	585	780	778	397	114
Crazy Horse (8)	114	350	1,496	1,336	201	74	72
Public Beach (9) (Day Use)	124	80	132	880	1,088	684	68

*Figures for Ah-Villa were supplied by Yuma County Parks Dept.

Figures for remainder were supplied by Arizona State Parks and "reflect total park visitation from all user groups...[including] overnight camping, boat launching only, and day use visitation ."

Table 4. Visitation Figures by Date and Location, Parker Strip and Lake Havasu areas. May 23 - 29, 1973.

Source: Microbiology,EPA-Region IX, 8/73

Figure 3 Blue Water Marina Beach
Parker Strip Colorado River, Arizona, May 27, 1973

Figure 4 Buckskin Mountain State Park
Effluent Pipe and Swimmers, Colorado River,
Arizona, May 27, 1973

Figure 5 Buckskin Mountain State Park
Effluent Pipe, May 30, 1973

Figure 6 Crazy Horse Campground Beach
Lake Havasu, Arizona, May 27, 1973

Figure 7 Crazy Horse Campground Beach,
Lake Havasu, Arizona, May 27, 1973

Figure 8 Lavatory and Percolation Bed, Crazy Horse Campground, Lake Havasu, Arizona, May 27, 1973

Figure 9 Crazy Horse Campground, Ponding on Percolation Bed, Lake Havasu in Background, Arizona, May 27, 1973

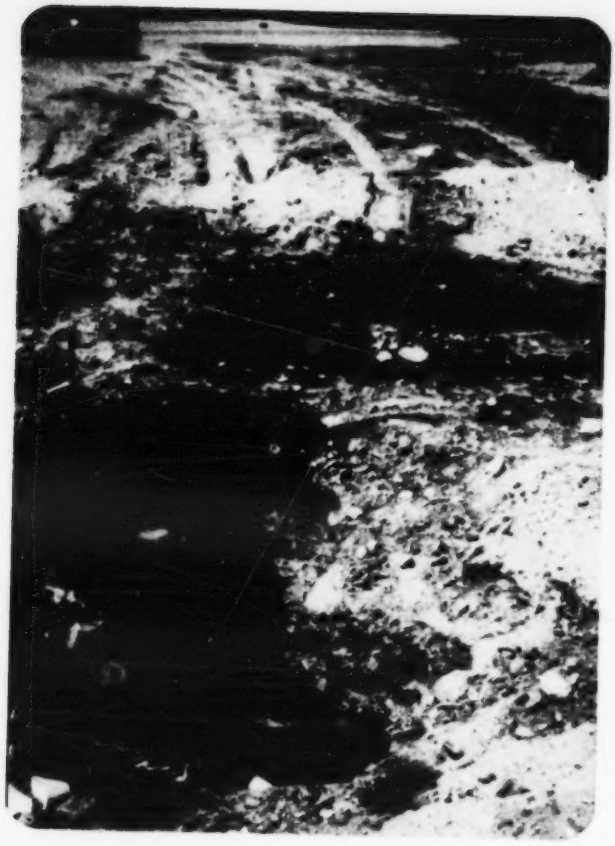

Figure 10 Crazy Horse Campground, Close-up of Ponding (Figure 9) on Percolation Bed, May 27, 1973

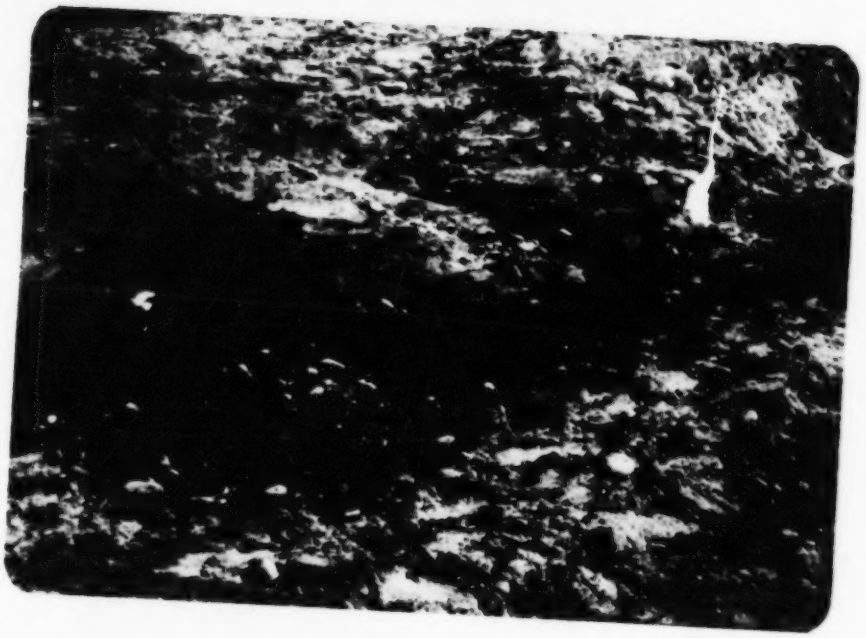

Figure 11 Crazy Horse Campground
Close-up of Ponding (Figure 9) on Percolation Bed
May 27, 1973

DISCUSSION

Although the entire reach of the Colorado River along the Parker Strip and Lake Havasu seemed to be heavily congested with people visiting over the Memorial Day Weekend, bacteriological results and photographic evidence showed contamination localized in three main areas: Blue Water Marina; Buckskin Mountain State Park; and Crazy Horse Campground (Lake Havasu). It is true that the bacteriological counts taken along Crazy Horse beaches were within the limits set by water quality standards; however ponding of sewage over the leach fields, which are neither posted nor fenced, constitutes an immediate public health hazard.

As may be observed from the field notes in Appendix 1, the River noticeably fluctuates in depth in the Buckskin Mountain State Park beach area. This variation is extreme enough to cause complete exposure of the effluent pipe from the treatment plant. Since the area is entirely accessible both from the beach and from the water and since the identity of the pipe and its contents is not posted, an unwary bather could be directly exposed to sewage and not know of it. That the danger exists is most graphically evidenced by recovery of disease-causing Salmonella organisms from Station 6B - receiving water opposite the effluent pipe.

The adequacy of a 10,000-gallon treatment plant in an area which was used by 780 people (Table 4, Buckskin Mountain, 5/26 and 5/27) is also questionable. The data clearly suggest that the treatment plant was overloaded during this holiday weekend. Since the number of people using the facility can be limited and since the effluent can be chlorinated, mechanisms do exist for alleviating the problem without going to the expense of enlarging the treatment plant.

Whatever the method chosen it is important to monitor the effluent especially since there was a chlorine residual of 0.5 measured on 5/28, the day the disease-causing organisms were recovered. One wonders where the residual was measured and what the length of contact time was before the effluent entered the River.

In the Blue Water Marina area there seem to be two distinct problems: (1) contamination above the beach and restaurant area; (2) contamination directly downstream of the beach. These may be investigated and/or solved in several ways.

Identification of the source of the upstream contamination cannot be made from this current survey. An on-site evaluation should be done to determine whether this was a chance occurrence (perhaps due to campers' use of the River or beach as a lavatory) or whether there is a continuing source of contamination (perhaps from an overloaded septic tank percolation field).

The downstream contamination seems directly linked to the crowded beach observed to be at the highest level on May 27 (see field notes in Appendix 1). The downstream station was in violation on May 27, but not on other days during the surveys. This problem would probably be alleviated by either limiting the number of people admitted to the beach or by providing additional sanitary facilities sufficient to serve the number of individuals using the area.

APPENDIX 1 Field Notes

May 25, 1973

0945: Buckskin - Station 6

Approximately 60 people bathing
Ranger says over 500 people may be admitted to "overflow area"
Ranger Dave Peterson will get me head counts daily, starting tomorrow including today's count

1100: Blue Water Marina

1A - no one in vicinity
1B - no one in vicinity
1C - approximately 100 people within sight of this station
cabanas appeared 3/4 full

1515: Day Use Area - Station 9

10 people bathing
25 on beach

May 26, 1973

0800: Buckskin State Park

300 as of 5/25
592 as of 5/26
expecting maximum of 650 on 5/27
Ranger Duane Hinshaw, supervisor

Count: 5/26

142 autos, trucks
6 motorcycles
x 4 average per vehicle
592 people

APPENDIX 1

May 26, 1973

0950: 8A [Crazy Horse]

40 people and 5 dogs in water

1000: 8B

30 in water
Beach literally bumper to bumper with cars, trucks, trailers, boats. Lines at bathrooms

1015: 9A,B [Day Use - State Park Beach]

100 in water; 200 on beach
Seems there was some overnight use here- reports by two witnesses, unconfirmed

1310: 1A (Blue Water Marina)

New signs have been erected, reading "Colorado River Indian Reservation. No Trespassing" No people in area

1315: 1B

About 80 people in vicinity - no one in water

1C

35 in water - very crowded immediately downstream in main beach area.

1345: Buckskin Mountain

6A 30 in water
6B 0 in water
6C 5 in water
About 150 in water in bathing area

APPENDIX 1

May 27, 1973

0930: Buckskin Mountain

Ranger reports about 600 in here today.
Two people in water at outfall. Got a picture of it (6B) 10 at 6A; 5 at 6C.
Water 1 ft. higher two hours later.

1050: Blue Water Marina

1A 0 in water.

1B 8 in water; lots of camping.

1C 60 - 200 in water in vicinity - very packed.

1D Station is at downstream boundary fence below Blue Water Marina Park. The entrance road is at HUD Sewage Treatment sign.
No one in water here.

1445: Crazy Horse 8A, B

150 - 200 in water in vicinity; very crowded on beach.
Observed one overflowing leachfield and took pictures.
Another was damp at the surface.
Witnesses said the lavatories were locked after dinner 5/26, and some were just being opened now.

Day Use Beach, 9A, B

100 in water
Toilets OK

APPENDIX 1

May 28, 1973

0930: Buckskin Mountain, 6A, B, C
No one in water at sample points

6B Water level 1 ft. below effluent pipe - effluent appeared slightly foamy [Salmonella isolated from this sample]

Ranger estimates maximum of 650 yesterday.
250-300 here this AM
Will try to give me their effluent analysis results from this weekend tomorrow AM

1050: Blue Water Marina

1A No one in water
1B No one in water - 6 skydivers landed offshore
1C 10 in water - Park appears 1/2 full

1105: 1D

No one in water

Crazy Horse

8A Little crowd - no one in water
8B 5 in water
Leachfield damp but not surfacing in a puddle as yesterday

Day Use Beach, 9A, B

100 - 150 in water

APPENDIX 1

May 29, 1973

Buckskin Mountain

6a, B No one in water. Two dead carp near effluent pipe (6B) D.O. was 1.0 for last 5 days. Measured in the aeration tank.

DAY	S.S.*	CHLORINE RESID.	REMARKS
Thursday (5/24)	4.5	1.0	-
Friday	5.0	1.0	-
Saturday	4.0	0.6	-
Sunday	4.0	0.5	-
Monday	6.0	0.5	Dirty effluent
Tuesday	5.5	0.8	-

*S.S.= Settleable solids. after 1/2 hour settling, morning readings.

Ranger Rourk

Maximum number Sunday and Monday 650, excluding possibly 100 who came in by boat. May be as high as 750 Sunday and Monday.
Their treatment plant was the most overloaded ever this weekend.
Less than 100 people here this AM.

Blue Water Marina

1A,B,C,D No one in water.

Crazy Horse

8A,B 5 in water. Leachfield OK

Day Use Beach

9A,B 20 in water.

APPENDIX 2 Field Notes - Boat Crew

Station 5 - Ah-Villa

Ranger estimates 6,000 - 7,000 people over the weekend.
On 5/26 and 27 - approximately 200 - 250 people observed in water.
On 5/28, 100 - 150.

Station 4A, B

Between Ah-Villa and this station approximately 40 people observed each day 5/26 - 28.

Station 7 [Polynesian Shores]

Numerous complaints from local people on water quality in their area.